

AMENDMENTS TO THE CLAIMS

1. (Amended) An assistant for digesting a lignocellulose material, which comprises a combination of:

(I) a nonionic surfactant (A) comprising one or more compounds represented by the general formula (1):



wherein R^1 is a branched alkyl group containing 4-24 carbon atoms represented by the general formula (2):



(wherein R^2 and R^3 are independently selected from the group consisting of straight-chain or branched alkyl groups containing 1-21 carbon atoms, and R^4 is an alkylene group containing 1-21 carbon atoms); m is an integer of at least 1, having an average of 4-20; A^1 is an alkylene group containing 3 or 4-carbon atoms; and n is 0 or an integer of at least 1, having an average of 0-15; wherein (C_2H_4O) and (A^1O) , in case of the average of n being 1-15, are linked random-wise and/or block-wise; with

(II) at least one selected from the group consisting of a quinone type digestion assistant and a polysulfide.

2. (Amended) An assistant for digesting for a lignocellulose material, which comprises a combination of:

(I) a nonionic surfactant (B) obtained by addition of an alkylene oxide to an aliphatic alcohol, said nonionic surfactant (B) comprising one or more compounds represented by the general formula (3):



wherein R^5 is a straight-chain, branched or cyclic aliphatic hydrocarbyl group containing 4-24 carbon atoms; p is an addition molar number of 4-20; A^2 is an alkylene group containing 3 or 4 carbon atoms; and q is an addition molar number of 0 or 1-15; wherein (C_2H_4O) and (A^1O) , in case of the average of q being 1-15, are linked random-wise and/or block-wise; said nonionic surfactant (B) having a weight-average molecular weight (M_w) and a number-average molecular weight (M_n) providing a ratio of M_w/M_n satisfying the relationship

$$M_w/M_n \leq -0.183 \times K^{-0.930} \times \ln X + 1.327 \times K^{-0.065} \quad (4)$$

wherein $\ln X$ is a natural logarithm of X ; X is an average addition molar number of the alkylene oxide per 1 mole of the aliphatic alcohol; and K is the number of carbon atoms in R^5 of the general formula (3); with

(II) at least one selected from the group consisting of a quinone type digestion assistant and a polysulfide.

3. (Amended) The assistant of Caime 1 [or 2], wherein said nonionic surfactant (A) [or said nonionic surfactant (B)] has an HLB of 6-18.

4. (Amended) An assistant for digesting a lignocellulose material, which comprises a combination of:

(I) at least one anionic surfactant selected from the group consisting of an anionic surfactant (C) represented by the general formula (5) and [and/or] an anionic surfactant (D) comprising one or more compounds represented by the general formula (6):





wherein R⁶ is a straight-chain, branched or cyclic aliphatic hydrocarbyl group containing 4-24 carbon atoms; A³ is an alkylene group containing 3 or 4 carbon atoms; r is 0 or an integer of at least 1, having an average of 0-15; k is an integer of 1 or 2; and M¹ and M² are monovalent cations; with

(II) at least one selected from the group consisting of a quinone type digestion assistant and a polysulfide.

5. (Amended) An assistant for digesting a lignocellulose material, which comprises:

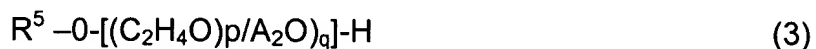
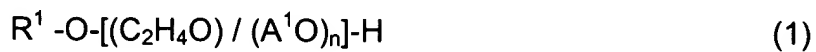
(a) at least one nonionic surfactant selected from the group consisting of a nonionic surfactant (A) and [and/or] a nonionic surfactant (B) ; together with

(b) at least one anionic surfactant selected from the group consisting of an anionic surfactant (C), an anionic surfactant (D) and anionic surfactant (E);

in a weight ratio of 100/0.1 - 100/30;

said nonionic surfactant (A) comprising one or more compounds represented by the general formula (1); said nonionic surfactant (B) being obtained by addition of an alkylene oxide to an aliphatic alcohol and comprising one or more compounds represented by the general formula (3) and having a weight-average molecular weight (Mw) and a number-average molecular weight (Mn) providing a ratio of Mw/Mn satisfying the relationship (4); said anionic surfactant (C) comprising one or more compounds represented by the general formula (5); said anionic surfactant (D)

comprising one or more compounds represented by the general formula (6); and said anionic surfactant (E) comprising one or more compounds represented by the general formula (7):



wherein R^1 is a branched alkyl group containing 4-24 carbon atoms represented by the general formula (2):



(wherein R^2 and R^3 are independently selected from the group consisting of straight-chain or branched alkyl groups containing 1-21 carbon atoms, and R^4 is an alkylene group containing 1-21 carbon atoms), R^5 and R^6 are straight-chain, branched or cyclic aliphatic hydrocarbyl groups containing 4-24 carbon atoms; R^7 is a straight-chain or branched alkyl group, alkenyl group, or mono- or di-hydroxyalkyl group, containing 4-24 carbon atoms; R^8 is an alkylene group containing 1-6 carbon atoms; m is an integer of at least 1, having an average of 4-20; p is a number of 4-20; A^1 , A^2 , A^3 and A^4 are alkylene groups containing 3 or 4 carbon atoms; n, r and s are 0 or an integer, of at least 1, having an average of 0-15; q is an addition molar number of 0 or 1-15; k is an

integer of 1 or 2; M^1 , M^2 and M^3 monovalent cations; wherein (C_2H_4O) and (A^1O) , in case of the average of n or q being 1-15, are linked random-wise and/or block-wise;

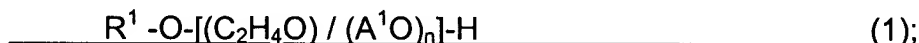
$$Mw/Mn \leq -0.183xK^{-0.930} \times \ln X + 1.327xK^{-0.065} \quad (4)$$

wherein $\ln X$ is a natural logarithm of X ; X is an average addition molar number of the alkylene oxide per 1 mole of the aliphatic alcohol; and K is the number of carbon atoms in R^5 of the general formula (3).

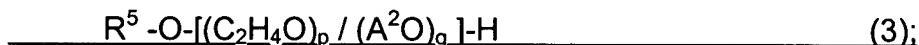
6. (Amended) The assistant of [any one of Claims 1-5] Claim 5, which is used in combination with at least one selected from the group consisting of a quinone type digestion assistant and [and/or] a polysulfide.

7. (Amended) A method for producing a pulp, which comprises digesting a lignocellulose material with an alkali or a sulfite in the presence of a digestion assistant; [wherein an] said assistant comprising at least one assistant (I) [(a) according to any one of Claims 1-6 is used as the assistant] selected from the group consisting of:

(A) a nonionic surfactant comprising one or more compounds represented by the general formula (1):



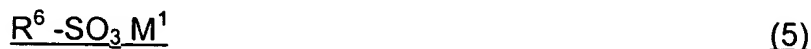
(B) a nonionic surfactant, obtained by addition of an alkylene oxide to an aliphatic alcohol, comprising one or more compounds represented by the general formula (3):



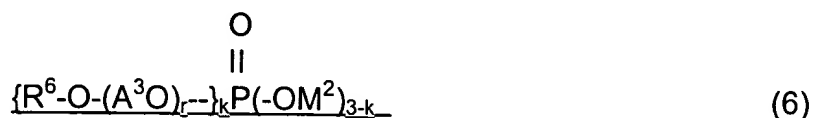
and having a weight-average molecular weight (Mw) and a number-average molecular weight (Mn) providing a ratio of Mw/Mn satisfying the relationship (4):

$$Mw/Mn \leq -0.183xK^{-0.930} \times \ln X + 1.327xK^{-0.065} \quad (4);$$

(C) an anionic surfactant comprising one or more compounds represented by the general formula (5):



(D) an anionic surfactant comprising one or more compounds represented by the general formula (6):



wherein R¹ is a branched alkyl group containing 4-24 carbon atoms represented by the general formula (2):



wherein R² and R³ are independently selected from the group consisting of straight-chain or branched alkyl groups containing 1-21 carbon atoms, and R⁴ is an alkylene group containing 1-21 carbon atoms); R⁵ and R⁶ are straight-chain, branched or cyclic aliphatic hydrocarbyl groups containing 4-24 carbon atoms; m is an integer of at least 1, having an average of 4-20; p is a number of 4-20; A¹, A² and A³ are alkylene groups containing 3 or 4 carbon atoms; n and r are 0 or an integer of at least 1, having an average of 0-15; q is an addition molar number of 0 or 1-15; k is an integer of 1 or 2; M¹ and M² are monovalent cations wherein (C₂H₄O) and (A¹O), in case of the average of n or q being 1-15, are linked random-wise and/or block-wise; LnX is a natural logarithm of X; X is an average addition molar number or the alkylene oxide per 1 mole of the aliphatic alcohol; and K is the number of carbon atoms in R⁵ of the general formula (3).

8. (Amended) The [A] method [for producing a pulp, which comprises digesting a lignocellulose material with an alkali or a sulfite in the presence of a digestion assistant] of Claim 7; wherein said [an] assistant (I) [(a) according to any one of Claims 1-5] is used together with at least one component (II) selected from the group consisting of a quinone type digestion assistant and [and/or] a polysulfide [as the assistant].

9. (Amended) The method of Claim 8, wherein the assistant (I) [(a)] is added beforehand prior to addition of the quinone type digestion assistant and/or the polysulfide, and after their addition, digesting is carried out.

10. (Amended) The method of Claim 9, wherein the lignocellulose material is heated after, during and/or before addition of the assistant (I) [(a)].